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Canadian Science Advisory Secretariat
Gulf Region | Science Response 2013/009

ATLANTIC SALMON (*SALMO SALAR*) RETURNS TO THE MIRAMICHI RIVER (NB) FOR 2012

Context

Atlantic Salmon for Gulf Region stocks are scheduled to be formally assessed every two years. The most recent assessment of the Atlantic salmon stock of the Miramichi River was prepared for the 2011 return year (DFO 2012). This science response report provides an update of the returns of Atlantic salmon to the Miramichi River for the 2012 return year. The report is the result of the Science Special Response Process of February 7, 2013. The returns of large salmon (>= 63 cm, fork length) to the Miramichi River in 2012 were estimated to be 13,630 fish (median value; 95% credibility interval 9,932 to 19,430). Small salmon (< 63 cm fork length) returns were estimated to be 8,010 fish (median value, 95% credibility interval 5,964 to 11,340). The low returns of large and small salmon in 2012 follow on the high returns of both size groups in 2011.

Background

The Miramichi River is considered to have the largest Atlantic salmon (*Salmo salar* L.) run of eastern North America. There are two major branches: the Northwest Branch covers about 3,950 km^2 and the Southwest Branch about 7,700 km^2 of drainage area. The two branches drain into a common estuary and subsequently drain into the Gulf of St. Lawrence at latitude 47°N. Two size groups of Atlantic salmon are defined. The small salmon category consists of fish less than 63 cm fork length. These fish have usually spent only one full year at sea (one-sea-winter) prior to returning to the river. The large salmon category consists of fish greater than or equal to 63 cm fork length. This size group is generally referred to as multi-sea-winter or just "salmon" and generally contains varying proportions of two-sea-winter and three-sea-winter maiden (first time) spawners as well as salmon that have spawned previously.

It is not possible to obtain absolute counts of salmon in the Miramichi River or its branches due to its physical size. As a result, the use of partial capture techniques are used to sample the runs which necessitates the use of mark and recapture methods to estimate run sizes. Details have been provided in previous assessments (Chaput 2010; Chaput and Douglas 2012).

Analysis and Response

The runs of Atlantic salmon to the two main branches of the Miramichi River are monitored using estuary trapnets. The DFO Science trapnet installed at Millerton is the index facility for the Southwest Miramichi whereas the DFO Science trapnet installed at Cassilis is the index facility for the Northwest Miramichi. These trapnets were installed and fished daily from the middle of May to the end of October and covered the migration period of Atlantic salmon to the Miramichi River. Total catches of salmon by size group at the trapnets for 1998 to 2012 are shown in Figure 1 and Appendix Table 1.

Two headwater protection barriers operated by the New Brunswick Department of Natural Resources provide indices of abundance for the Northwest Miramichi and the Southwest Miramichi rivers. In 2012, the protection barriers were installed and fished daily from the end of May to the end of October and covered the migration period of Atlantic salmon to the Miramichi River. Total counts of salmon by size group at the barriers for 1998 to 2012 are shown in Figure 1 and Appendix Table 1.

The large salmon catches or counts at all Miramichi monitoring facilities in 2012 were down relative to 2011 (-25% to -59%) and the previous five-year averages (-16% to -35%). Similarly, counts of small salmon were down in 2012 relative to the previous year (-75% to -78%) and the previous five-year averages (-65% to -77%) (Figure 1; Appendix Table 1). Catches or counts of large and small salmon at each facility in 2012 were below the 1998 to 2012 average (Figure 1).

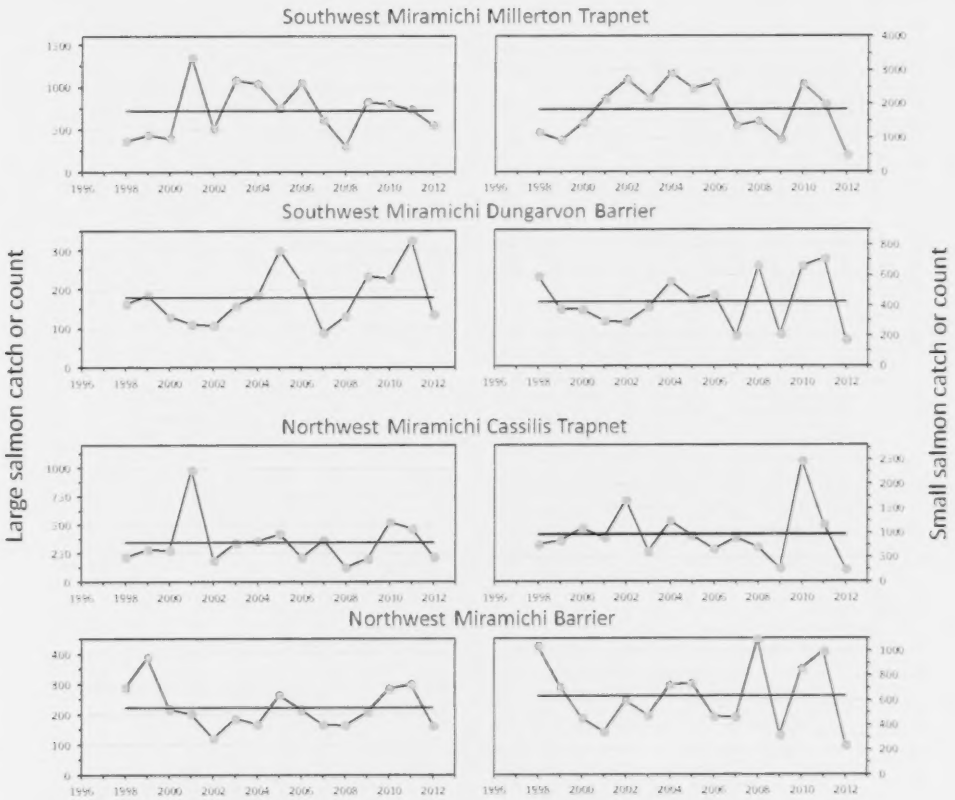
Southwest Miramichi Millerton Trapnet
Southwest Miramichi Dungarvon Barrier
Northwest Miramichi Cassilis Trapnet
Northwest Miramichi Barrier
Large salmon catch or count
Small salmon catch or count

Figure 1. Catches or counts of large salmon (left panels) and small salmon (right panels) at monitoring facilities in the Miramichi watershed between 1998 and 2012. The horizontal line in each figure is the average of the illustrated time series, 1998 to 2012. Monitoring facilities are: upper row – Southwest Miramichi Millerton trapnet, second row – Southwest Miramichi Dungarvon Barrier, third row – Northwest Miramichi Cassilis trapnet, bottom row – Northwest Miramichi Barrier.

Estimates of returns

Similar to previous years, mark and recapture experiments were used to estimate the returns of Atlantic salmon by size group to the Miramichi River and to each of the Northwest and

Southwest Miramichi branches. The previously peer reviewed Bayesian hierarchical model used to estimate returns for the 2010 and 2011 return years was used for the 2012 return year estimate (DFO 2010, 2012; Chaput 2010; Chaput and Douglas 2012). Similarly, methods used to summarize the biological characteristics and to determine the level of conservation egg requirements attained were the same as those used in previous assessments (DFO 2010, 2012).

The estimated returns of large salmon to the Miramichi River in 2012 were 13,630 fish (95% credibility interval: 9,932 to 19,430 fish), 57% below returns in 2011 and 31% below the previous five-year average. The estimated returns of small salmon to the Miramichi River in 2012 were 8,010 fish (95% credibility interval: 5,964 to 11,340 fish). The returns of small salmon in 2012 were the lowest of the time series 1998 to 2012, 82% below returns in 2011, and 76% below the previous five-year average (Figure 2; Appendix Table 2).

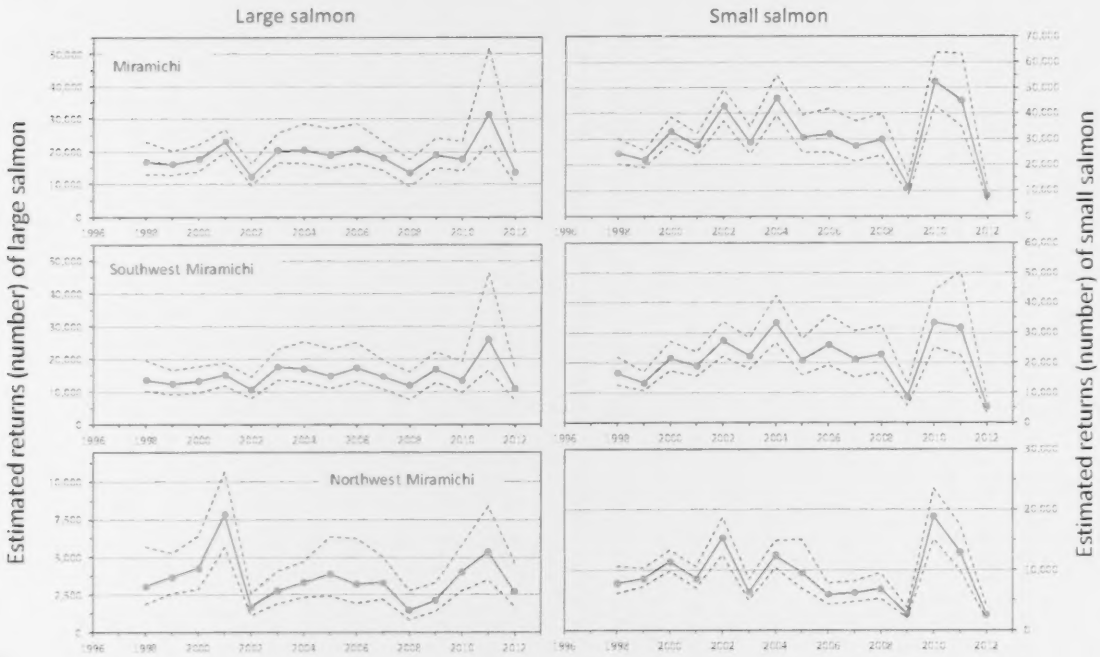

Figure 2. Estimated returns (number of fish; median and 95% Bayesian credibility interval) of large salmon (left panels) and small salmon (right panels) to the Miramichi River overall (upper panels), to the Southwest Miramichi River (middle panels) and to the Northwest Miramichi River (lower panels) for 1998 to 2012.

The returns to the Southwest Miramichi River in 2012 were 10,790 (95% credibility interval: 7,268 to 16, 660) large salmon and 5,341 (95% credibility interval:3,484 to 8,454) small salmon. The large salmon returns in 2012 were 58% below returns in 2011 and 35% below the average returns during the previous five years. The small salmon returns in 2012 were 83% below returns in 2011 and 77% below the average returns during the previous five years (Figure 2; Appendix Table 2).

The returns to the Northwest Miramichi River in 2012 were 2,680 (95% credibility interval:1,669 to 4,640) large salmon and 2,587 (95% credibility interval:1,914 to 3,933) small salmon. The

large salmon returns in 2012 were 50% below returns in 2011 and 17% below the average returns during the previous five years. The small salmon returns in 2012 were 80% below returns in 2011 and 73% below the average returns during the previous five years (Figure 2; Appendix Table 2).

The conservation egg requirement was not met for the Miramichi River nor its two major branches in 2012. Before accounting for harvests or removals from fisheries, eggs in the returns were sufficient to achieve 72% of the conservation egg requirement of the Miramichi River overall, 83% of the conservation egg requirements for the Southwest Miramichi River and 48% of the conservation egg requirement for the Northwest Miramichi River (Appendix Figure 1).

The percentage of 2SW maiden salmon in the large salmon returns in 2012 was 70%, lower than the percentage observed in 2011 but similar to levels observed in previous years (Appendix Figure 3). Repeat spawners represented 30% of the large salmon sampled at DFO index facilities in 2012.

Over 90% of the large salmon in the Miramichi, Southwest, and Northwest were female in 2012. Females represented 11% of the small salmon in the Southwest Miramichi and 14% of the small salmon in the Northwest Miramichi (Appendix Figure 4).

The mean fork length of large salmon in 2012 was 77.6 cm (78.1 cm in the Northwest and 77.4 cm in the Southwest) which was similar to previous years. Overall, small salmon had a mean fork length of 53.9 cm (53.7 cm in the Northwest and 53.9 cm in the Southwest), smaller than mean lengths observed since the early 1990s (Appendix 4).

Conclusions

Returns of small salmon to the Miramichi River in 2012 were low and followed on the near record high returns observed in 2011. Returns of large salmon in 2012 also decreased relative to 2011 but much less than for those of small salmon.

Conservation requirements for the Miramichi River were not attained in 2012. They had been attained in 2011.

Contributors

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Approved By

Ghislain Chouinard	Date
Regional Director Science Gulf Region	February 21,2013

Sources of information

This Science Response Report results from the Science Special Response Process of February 7, 2013 2013 to review the estimates of returns of Atlantic Salmon to the Miramichi River in 2012. Additional publications from this process will be posted on the Fisheries and Oceans Canada Science Advisory Schedule as they become available.

Chaput, G. 2010. Assessment of Atlantic salmon (*Salmo salar*) to the Miramichi River (NB) for 1998 to 2009. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/092. iv + 70 p.

Chaput, G., and Douglas, S. 2012. Estimated returns of Atlantic salmon (*Salmo salar*) to the Miramichi River and each branch, 1998 to 2011. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/102. ii + 56 p.

DFO. 2010. Assessment of Atlantic salmon in the Miramichi River (NB), 1998 to 2009. DFO Can. Sci. Advis. Sec. Sci. Resp. 2010/005.

DFO. 2012. Stock status of Atlantic salmon (*Salmo salar*) in DFO Gulf Region (Salmon Fishing Areas 15 to 18). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/040.

Appendices

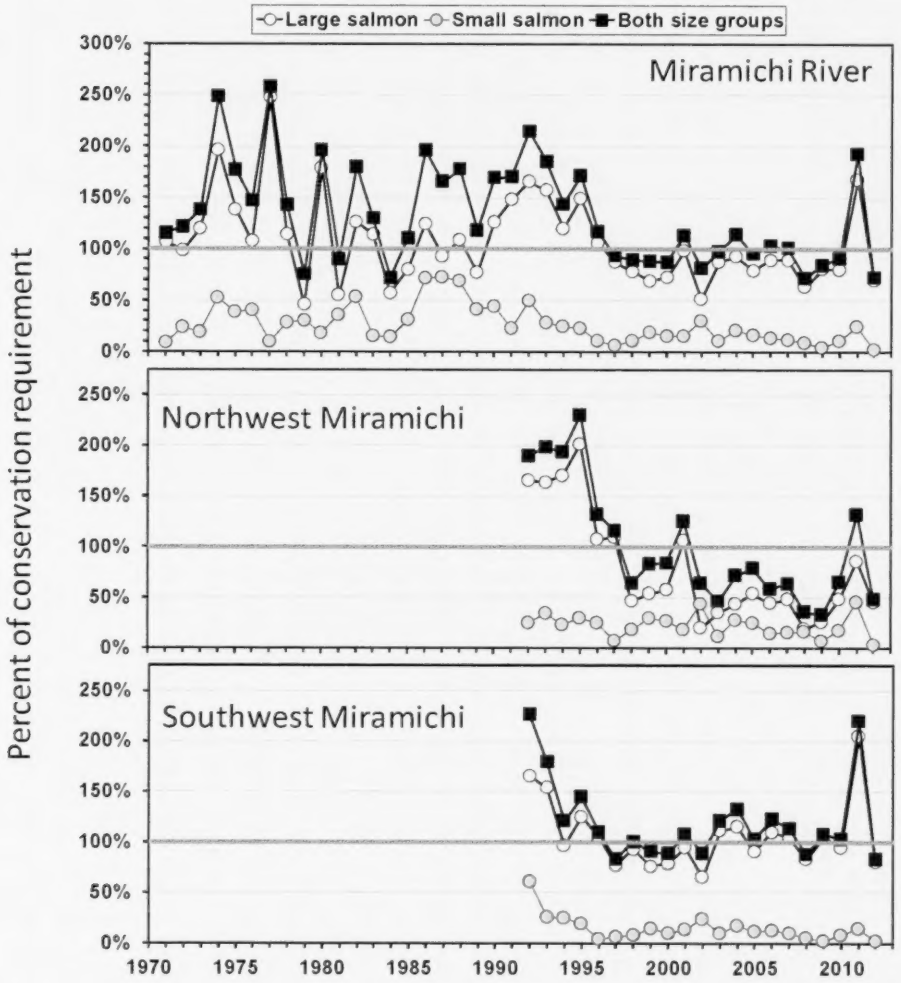
Appendix Table 1. Catches or counts of Atlantic salmon by size group at monitoring facilities in the Miramichi watershed, 1998-2012.

	Catches or counts of large salmon				Catches or counts of small salmon			
	Southwest Miramichi		Northwest Miramichi		Southwest Miramichi		Northwest Miramichi	
Year	Millerton trapnet	Dungarvon Barrier	Cassilis trapnet	NW Miramichi Barrier	Millerton trapnet	Dungarvon Barrier	Cassilis trapnet	NW Miramichi Barrier
1998	363	163	217	289	1158	592	758	1038
1999	436	185	280	387	924	378	835	708
2000	395	130	277	217	1442	372	1090	456
2001	1352	111	983	202	2153	295	893	344
2002	510	107	188	121	2718	287	1664	595
2003	1080	158	339	186	2182	389	617	478
2004	1040	185	358	167	2910	559	1232	723
2005	750	300	417	262	2447	441	932	735
2006	1047	217	210	214	2636	468	659	469
2007	613	88	365	166	1353	195	893	460
2008	298	131	124	164	1485	664	704	1094
2009	824	234	204	207	949	207	270	315
2010	798	228	524	284	2591	660	2474	852
2011	732	327	464	298	2000	711	1170	995
2012	549	135	217	163	491	169	252	237
Average of 1998 to 2012								
	719	180	344	222	1829	426	963	633
2012 as % of 2011								
	-25%	-59%	-53%	-45%	-75%	-76%	-78%	-76%
2012 as % of previous five-year average								
	-16%	-33%	-35%	-27%	-71%	-65%	-77%	-68%

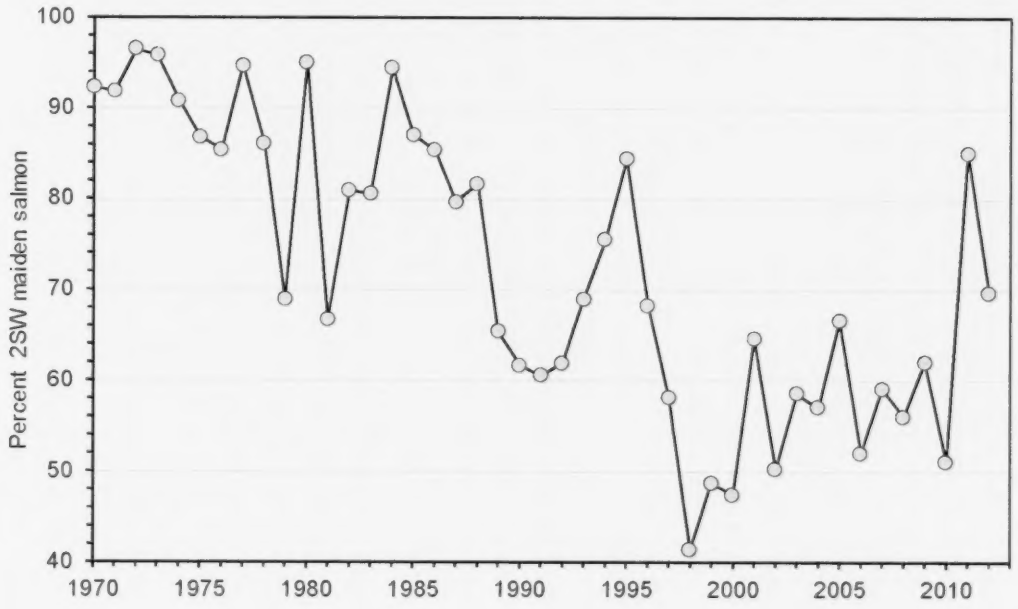
Appendix Table 2. Estimated returns (median, 95% Bayesian Credibility Interval) of small salmon and large salmon to the Miramichi River, 1998 to 2012.

		Small salmon return			Large salmon return		
	Year	Median	95% BCI		Median	95% BCI	
Miramichi River	1998	24,380	20,110	30,060	16,740	12,970	22,920
	1999	21,860	18,960	25,600	16,090	12,760	20,060
	2000	32,820	28,540	38,510	17,550	13,830	22,150
	2001	27,580	23,870	32,270	22,960	19,710	26,660
	2002	42,680	37,020	49,340	12,240	9,651	16,160
	2003	28,650	24,040	34,810	20,320	16,460	25,660
	2004	45,690	39,070	54,900	20,430	16,410	28,520
	2005	30,630	24,770	39,270	18,740	14,740	27,080
	2006	31,810	24,930	41,650	20,690	16,420	28,490
	2007	27,370	21,210	36,970	17,890	14,070	23,000
	2008	29,730	23,540	39,740	13,390	9,165	17,600
	2009	11,260	8,332	15,480	18,910	14,930	24,160
	2010	52,280	43,080	63,740	17,580	13,930	23,200
	2011	44,950	34,840	63,360	31,360	22,240	51,720
	2012	8,010	5,964	11,340	13,630	9,932	19,430
Southwest Miramichi	1998	16,390	12,490	21,810	13,490	10,030	19,590
	1999	13,190	10,560	16,830	12,350	9,032	16,480
	2000	21,370	17,220	27,130	13,170	9,575	17,710
	2001	18,860	15,420	23,520	15,080	11,720	18,770
	2002	27,280	22,100	33,810	10,510	7,905	14,510
	2003	22,250	17,800	28,180	17,480	13,530	22,880
	2004	33,230	26,780	42,450	17,010	12,980	25,260
	2005	20,740	15,740	27,930	14,670	10,980	23,060
	2006	25,890	19,170	35,710	17,240	13,190	24,940
	2007	21,100	15,150	30,600	14,520	10,690	19,600
	2008	22,680	16,740	32,330	11,840	7,622	16,050
	2009	8,576	5,703	12,610	16,750	12,770	22,100
	2010	33,310	25,070	44,170	13,450	9,803	19,140
	2011	31,640	22,380	50,430	25,900	16,570	46,330
	2012	5,341	3,484	8,454	10,790	7,268	16,660
Northwest Miramichi	1998	7,842	6,094	10,650	3,058	1,857	5,684
	1999	8,587	7,277	10,280	3,668	2,584	5,218
	2000	11,370	9,821	13,300	4,264	2,881	6,367
	2001	8,627	7,090	10,600	7,824	5,624	10,670
	2002	15,270	12,560	18,670	1,676	1,106	2,563
	2003	6,298	4,957	8,522	2,767	1,863	4,078
	2004	12,370	10,350	14,830	3,318	2,299	4,713
	2005	9,615	7,017	15,040	3,873	2,388	6,331
	2006	5,870	4,312	7,778	3,198	1,917	6,239
	2007	6,186	4,713	8,168	3,292	2,178	5,009
	2008	6,879	5,232	9,571	1,432	844	2,744
	2009	2,638	1,946	3,766	2,095	1,350	3,307
	2010	18,850	15,100	23,490	4,042	2,751	5,800
	2011	12,960	9,947	17,400	5,334	3,478	8,373
	2012	2,587	1,914	3,933	2,680	1,669	4,640

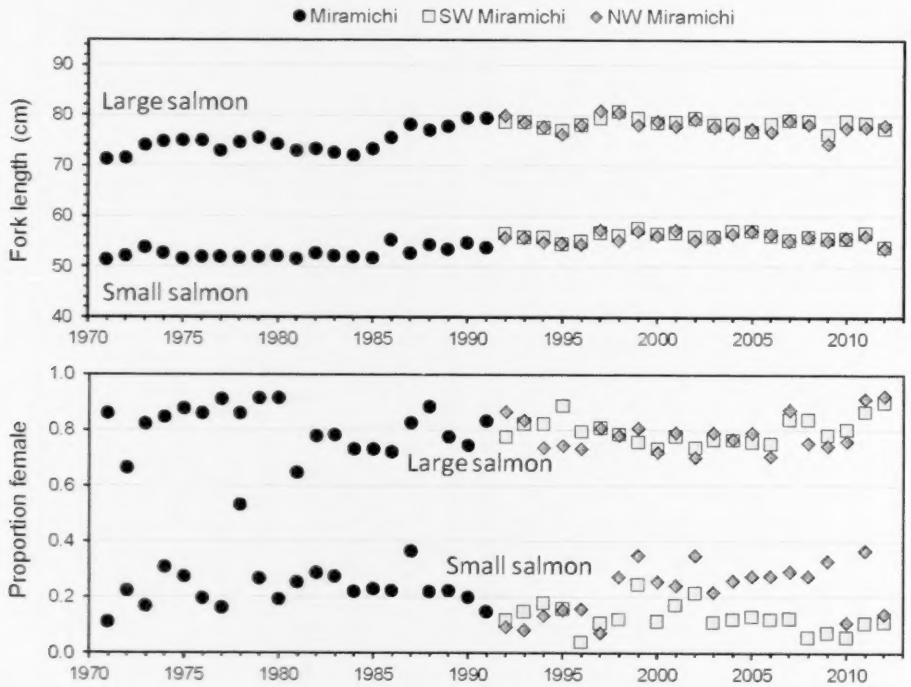
Appendix Figure 1. The percentage of the conservation egg requirement contributed by size group and combined in the returns to the Miramichi River overall (upper panel for 1970 to 2012), to the Northwest Miramichi River (middle panel for 1992 to 2012), and to the Southwest Miramichi River (lower panel, 1992 to 2012).



Appendix Figure 2. Percent 2SW maiden salmon from the large salmon category (≥ 63 cm) sampled at DFO index trapnets in the Miramichi estuary between 1970 to 2012.



Appendix Figure 3. Biological characteristics of Atlantic salmon from the Miramichi River and for each of the Southwest Miramichi and Northwest Miramichi branches. Upper panel summarizes summarizes the average fork length of small salmon and large salmon size groups for the Miramichi River (1970-1991), the Northwest Miramichi, and Southwest Miramichi branches for 1992 to 2012. The lower panel summarizes the proportions female salmon in the large salmon and small salmon categories for the same rivers and corresponding time periods.



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